Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
Tech ID: 23654 / UC Case 2008-323-0

BRIEF DESCRIPTION
A novel technique of improving performance in nonpolar LEDs by obtain high polarization ratios.

BACKGROUND
In recent years, III-V nitride-based blue and green LEDs have begun to emerge in general lighting and full color display applications. Internal electrical polarization is a unique property of the (Al,In,Ga)N system. Since atoms in the III-V nitride system do not maintain their ideal positions, this polarization field almost always exists along the c-axis, making the c-plane a polar plane. In contrast, III-V nitride-based LEDs conventionally grown on the c-plane show negligible light polarization.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a novel technique to obtain high polarization ratios from nonpolar LEDs, thereby improving performance. The present invention accomplishes higher polarization ratios in electroluminescence from nonpolar LEDs by increasing the indium content in light-emitting layers. A possible modification of this invention is to introduce strain controlling layers in the LED structure, which results in increased polarization ratios. The present invention requires no extra process in material growths, clean room processing, or device packaging.

ADVANTAGES
▶ Higher polarization ratios in nonpolar LEDs
▶ No additional manufacturing steps necessary
▶ Size and energy efficient backlighting

APPLICATIONS
▶ Backlighting for liquid crystal displays (LCDs)
▶ Other lighting applications

PATENT STATUS

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Number</th>
<th>Dated</th>
<th>Case</th>
</tr>
</thead>
</table>

RELATED CASES
2008-323-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
▶ Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Subtrates
▶ High Efficiency LED with Optimized Photonic Crystal Extractor
▶ Edge-Emitting Laser Diode with Via-Activated Tunnel Junction Contact
Multifaceted III-Nitride Surface-Emitting Laser

Tunable White Light Based on Polarization-Sensitive LEDs

Cleaved Facet Edge-Emitting Laser Diodes Grown on Semipolar GaN

III-Nitride VCSEL with a High Indium Content Active Region

Growth of High-Performance M-plane GaN Optical Devices

Packaging Technique for the Fabrication of Polarized Light Emitting Diodes

Improved Anisotropic Strain Control in Semipolar Nitride Devices

High Light Extraction Efficiency III-Nitride LED

Photoelectrochemical Etching for Chip Shaping Of LEDs

III-V Nitride Device Structures on Patterned Substrates

Hexagonal Wurtzite Type Epitaxial Layer with a Low Alkali-Metal Concentration

Method for Increasing GaN Substrate Area in Nitride Devices

Burying Impurities And Defects In Regrown III-Nitride Structures

Growth of Planar, Non-Polar, A-Plane GaN by Hydride Vapor Phase Epitaxy

Single or Multi-Color High Efficiency LED by Growth Over a Patterned Substrate

GaN-Based Thermoelectric Device for Micro-Power Generation

Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patterning

Improved Manufacturing of Semiconductor Lasers

LED Device Structures with Minimized Light Re-Absorption

Improved Light Extraction with Geometrically Tuned LED Arrays

Growth of Planar Semi-Polar Gallium Nitride

Nonpolar (Al, B, In, Ga)N Quantum Well Design

UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys

Defect Reduction of Non-Polar and Semi-Polar III-Nitrides

III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture

Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-150)

Suppression of Defect Formation and Increase in Critical Thickness by Silicon Doping

Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures

Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD